

# PEPPER (W.) & STENGEL (A.)

FROM THE PEPPER LABORATORY OF CLINICAL MEDICINE.

No. 4.

## DIAGNOSIS OF DILATATION OF THE STOMACH.

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THE diagnosis of dilatation of the stomach meets wth two difficulties at the very outset : first, the class of cases to which the term is applicable, and, secondly, the difficulty of determining the lesser grades on account of the variability in the size of the normal organ. It would seem simple enough to decide what class of cases belong properly to this group of diseases ; but practical experience leads us to believe that, though the diagnosis is made with unwarrantable frequency by those who are guided by superficial examination and by clinical symptoms often not at all distinctive, those who have pursued their studies from the modern scientific standpoint, on the other hand, withhold the diagnosis in certain instances in which a careful consideration of the whole subject would warrant the application of the term under discussion. The group of cases to which the latter observation has special reference is that designated atony of the stomach or motor insufficiency.

All writers, it is true, have recognized forms of dilatation dependent upon atony of the muscular walls of the stemach ; but it has been customary to apply the term atonic dilatation to cases in which the process is well advanced, reserving the names motor insufficiency and simple atony to cases supposed to represent loss of motor function without change of size of the organ. This view, we believe, is incorrect and founded on too narrow a consideration of the conditions present in the stomach. There are doubtless cases of chronic interstitial inflammation of the stomach, or perhaps even of ordinary chronic gastritis, in which the organ is not enlarged and yet in which the motor function is diminished, just as there are cases of chronic interstitial myocarditis without



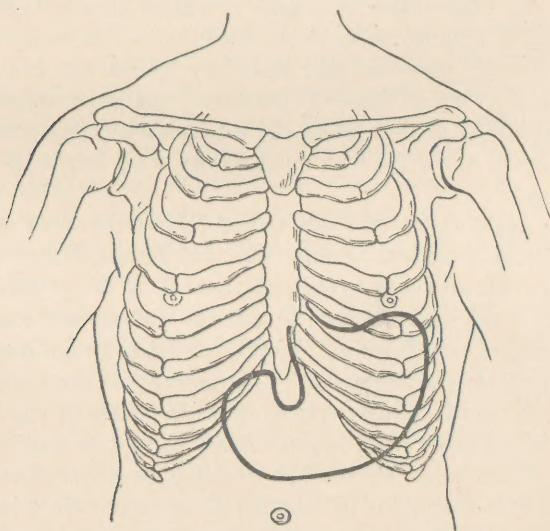
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cardiac dilatation and in which the heart-power fails; but the term atony of the stomach is here considered rather as applying to cases of neurotic or degenerative weakness of the muscle itself, and in such cases we hold there is and must be from the first some, though possibly little, dilatation, just as in cardiac weakness due to obscure disturbances of innervation or to degeneration of the muscle-fibres a certain amount of dilatation must exist. Beginning with a primary disease or atony of the muscle of a hollow viscus there is, of course, a period when no enlargement has occurred; but this period is practically of no duration, for the very first evidence of the disease must, as a matter of course, be due to relaxation—that is, enlargement or dilatation. We hold, therefore, that what is termed atony of the stomach is merely a beginning-stage of actual dilatation, which may or may not progress, and that it should be so classified.

When, however, we approach the second difficulty alluded to, viz., the determination of the existence of dilatation in the anatomical sense by actual demonstrative methods, we at once realize the comparative inutility of all the plans proposed. The matter would be simple enough if it were possible to assign any definite limits to the normal organ or to determine a normal capacity; but both of these are impossible tasks. As far as the normal outline and position of the stomach are concerned, we are quite firm in the belief that Luschka's outlines will be sufficiently represented by the accompanying figure. It will be noted that the pylorus lies in the angle between the right border of the xiphoid cartilage and the right costal margin; that the lower border or greater curvature is well above the umbilicus; and that the fundus lies beneath the base of the left lung and almost completely covered by its projecting margins. There is doubtless considerable movability with the respirations and with increased or decreased amounts of food; but the general points agree very closely with our observations in post-mortem examinations; and the latter, we may assert from our own experience in cases studied during life and post mortem and from the recent investigations of Meinert, furnish reliable indications of the position of the organ during life. We cannot, therefore, agree with those (Martius, Meltzing, and others) who assert that the normal position of the inferior margin of the stomach is as low as the umbilicus or lower. Such views, we are convinced, are based upon either unreliable methods or upon the study of cases of downward dislocation of the pylorus or the abnormal vertical position of Kussmaul. In these latter cases the stomach is not of necessity enlarged, though this may frequently be the case; but in any event it is to be noted that when the lower margin of the organ lies near

the umbilicus or below it, and is due, in the main, to dislocation, a corresponding dislocation of the pylorus and of the lesser curvature may be expected. When, on the other hand, there is actual dilatation of the stomach the lower margin is similarly placed, but the lesser curvature and pylorus are then much less displaced. Some dislocation does occur in nearly all cases of dilatation excepting such as are complicated with adhesion to the liver and other structures; but the downward displacement of the lower curvature is far in excess of that of the lesser curvature and pylorus in cases in which the dilatation is the principal or primary condition and the dislocation merely subsidiary or secondary. To this extent the study of the normal position of the stomach is, in our estimation, of value, and the recognition of the vertical position as an abnormal one of importance.

FIG. 1.



Normal position of the stomach. (After LUSCHKA.)

The second point concerning the anatomy of the organ to which we have alluded as offering difficulties in the recognition of dilatation is the size of the organ. That this varies greatly in different individuals would seem to require no special demonstration, but studies have been recorded which indicate how great a variability exists within the limits of what may be termed normal structure. In the casts made under the

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direction of v. Ziemssen it was found that the difference in shape, as well as size, of the stomach was very considerable in persons of about the same size; and Pacanowski found great variations in the area of gastric tympany in eighty-one cases. In Ziemssen's series the capacity of the organ was determined by filling specimens with water, and was found to fluctuate markedly; the greatest capacity, however, being 1680 c.cm. We have ourselves made studies in the same direction, taking cases in which no suspicion existed of gastric disease. The stomach in each case was filled with water under a pressure of about 25 cm. (part of the oesophagus being left attached). The smallest organ was found in a boy of nineteen years, 1.73 m. in height, who had died of pulmonary phthisis. The stomach in this case held but 500 c.cm. of water. The largest stomach was found in a woman of twenty-nine years, of rather delicate construction, and 1.55 m. in height. In this case the stomach held 2600 c.cm. In other cases the capacity varied greatly between these limits, that of a number being over 1680 c.cm.—Ziemssen's maximum. It may further be observed that Beneke's figures also indicate a far greater capacity than do those of Ziemssen; but, after all, it is evident that the variability in the size of the stomach is too great to permit of absolute limits even for the maximum size of what might be considered a healthy organ.

The mere question of size has, therefore, lost much of its old-time significance as an indication of dilatation, and Ewald, Riegel, and others very properly call attention to the fact that all of the physical signs of enlargement of the stomach may be present without any evidence that there is functional insufficiency. To this condition Ewald has given the name megastria or megalogastria. Enlargement of the organ of such degree that it may be clearly spoken of as in excess of the maximum size found in ordinary healthy individuals cannot at once be termed dilatation. There must always be evidences that the motor power is deficient and that stagnation of food is taking place. It is going a step too far, however, to dispose entirely, as Boas does, of the term dilatation, and to classify all cases under the heading: Gastric Insufficiency, of the first or the second degree. Dilatation is a pathological entity not to be set aside in this manner, and though we agree with Boas in the important part he assigns to the want of motor power, we cannot agree that the latter should be made the basis of classification. There are undoubtedly cases of actual and sometimes considerable dilatation of the stomach in which the motor power has been augmented almost or quite to the point of restoration of sufficiency at first impaired by pyloric obstruc-

tion. A classification based entirely upon the study of the motor function would fail to include such cases among the pathological conditions of the organ, though in but a short time rupture of the compensation might occur, and the cases might at once fall into the category of insufficiency of the second degree, or of great gastric dilatation. Boas's classification owes its origin, we believe, to a recognition of the difficulty of determining whether the size of the organ has become augmented or not; but this is a difficulty that must be overcome, and not evaded.

From these preliminary remarks we may conclude that the term dilatation of the stomach is to be applied to a greater number of cases than has usually been admitted, and that in particular the condition known as simple atony or motor insufficiency is really an early stage of dilatation; that the mere determination of the size of the organ is not to be considered a reliable indication of dilatation, though, on the other hand, the importance of enlargement must not be overlooked.

We would classify all cases in two groups, designating these as *tonic dilatation* and *obstructive dilatation*, respectively. We would reject the term mechanical dilatation, since certain cases of dilatation are essentially mechanical, in that they result from traction upon the walls of the organ, and yet are not mechanical in the sense in which this term is ordinarily applied, viz., as indicating pyloric obstruction. It is not our purpose to speak exhaustively of the causes of dilatation of the stomach, but we wish rather to review briefly the principal conditions giving rise to this disease.

Atonic dilatation may occur in two ways; first, by primary or absolute atony of the walls; and, secondly, by secondary or relative weakness. Primary atony of the walls with atonic dilatation of slight degree is a much more frequent condition than has been generally believed. It may occur in persons of relaxed fibre, in nervous, anaemic, or debilitated conditions, resulting from a variety of causes; or, on the other hand, it may be a complication of chronic or even of acute gastritis. In rare cases, as in those of Fagge, Endmann, Oser, Kundrat, and Boas, atonic dilatation may be acute, and in such instances it is prone to be serious. Some of these cases, however, are doubtless obstructive, the pyloric stenosis being due to spasm, the result of acute indigestion or hyperacid secretion. Usually it is a slowly progressive or a stationary process, largely influenced by the general conditions of the patient's system.

In the group of atonic dilatation due to relative atony of the walls may be included the cases in which overeating and drinking are responsible for the disease. In such cases the constant strain of large amounts

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of food gradually induces relaxation and enlargement; and it is likely, also, that hypersecretion and hyperacidity are first set up, and that these are largely the cause of the subsequent dilatation, being active in the way of causing pyloric spasm, or even hypertrophic thickening of the pyloric ring. Another form of relative atony of the walls of the stomach is that produced by adhesions or by the dragging of the omentum in corpulent persons. In such cases the natural tone of the stomach-walls is overcome and more or less relaxation ensues. Somewhat similar conditions are present in cases in which cicatrices of gastric ulcers occupy parts of the stomach removed from the pylorus. There results a weakening of the walls of the organ which terminates in dilatation.

The group of obstructive dilatation of the stomach comprises the cases dependent upon pyloric stenosis, whether this be organic or functional, and due to disease of the pylorus itself or to outside causes. It is scarcely necessary to make more than passing mention of the causes of organic pyloric obstruction. Carcinoma and cicatrices of pyloric ulcers are the important forms of stenosis; but occasionally other neoplasms or hypertrophy of the pyloric fibrous or muscular tissues may be active. Among the rarer neoplasms causing obstruction we have seen a myoma of the muscularis which projected into the stomach and acted like a ball-valve, very much as, in certain rare cases reported in the literature, peach-stones or other foreign bodies have acted. In another case under our observation the stenosis was caused by infiltrating sarcoma. A number of times we have seen the pylorus occupied by a ring of fibromuscular tissue somewhat resembling, in its microscopic appearances, a scirrhous cancer. In such cases there has generally been a history of painful disorder of digestion and of constant hyperacidity, and we have no doubt that frequently repeated spasms, probably combined with inflammatory attacks, account for the formation of such hypertrophic conditions. Among the cases of so-called annular myoma of the pylorus, many, no doubt, belong to the cases here referred to. Repeated spasm may, however, result in dilatation without notable organic change at the pylorus. The antecedent causes which occasion spasm may be various. Hyperacidity and hypersecretion, and these in turn often dependent upon overeating and alcoholic excess, have been referred to. Acute and painful ulcers near the pylorus may act in a similar manner, and possibly displacement of the kidney or other abdominal diseases may give rise to reflex pyloric contraction.

Dislocation of the stomach, and especially the extreme vertical position, may cause a mechanical obstacle to the discharge of the gastric

contents from the position alone, and a more serious obstruction in the form of a sharp angulation of the horizontal portion of the duodenum, or of the junction between the stomach and duodenum.

The causes of pyloric obstruction outside the stomach itself are very numerous. Tumors may compress the pylorus, or, as in one of our cases, inflammatory adhesions may bind it firmly to the head of the pancreas and the posterior abdominal wall. Some attention has been called to displacement of the right kidney as a cause of dilatation by Bartels, Malbranc, Schütz, Litten, and others, and one of the cases here reported by us belongs in the same class. We do not feel warranted in asserting that the gastrectasis in such cases results entirely from pressure upon the duodenum; nor, on the other hand, does it seem likely that the conditions are wholly coincidental. A consideration of the anatomical relations permits the suspicion that injurious pressure upon the duodenum might result from moderate displacement of the right kidney, especially if such displacement were due to downward and inward pressure of the liver, resulting from tight lacing. Some authors have urged that the very movability argues the unlikelihood of serious pressure occurring in this way; but with a moderately movable kidney the conditions are just such, we would urge, that so long as the thoracic compression is continued the kidney is forced against the vertical portion of the duodenum. It has further been claimed that the peristaltic movements of the intestines are so active that the pressure of the kidney could scarcely cause obstruction. To this we would reply that the portion of the duodenum pressed upon by a displaced kidney is one of the least movable parts of the entire tract, being quite firmly attached by the reflection of the peritoneum lying in front of it. While for these reasons we are still disposed to believe that displacement of the kidney may occasion gastrectasis by direct pressure upon the duodenum, we are also inclined to believe that other causes act at the same time. Thus simultaneous gastric and visceral descent may cause angulation and compression of the duodenum, while reflex nervous spasm of the pylorus or neurotic relaxation of the entire organ may be the principal or the contributing causes in some cases.

**DIAGNOSIS.** The ultimate diagnosis of dilatation of the stomach must rest upon the recognition of deficiency in the power of the stomach to propel its contents into the intestine and upon the discovery of enlargement of the organ; but there are numerous features presented in the disease of a more or less significant character, which are discovered in a systematic examination by the methods of physical investigation. In

very many cases the existence of the disease may be suspected from some of these general manifestations without minute or special examination of the stomach, and it is important to recognize these general features, especially in cases in which the degree of enlargement is such that doubt may arise as to the real existence of dilatation, or in which the motor function cannot be properly estimated or is not greatly disturbed.

We take up the diagnostic features of the disease in the usual order of physical examinations.

*Inspection.* The patient usually presents more or less characteristic general appearances. He is emaciated, often cadaverous, in appearance; the skin is dry and harsh and may be unnaturally wrinkled; after a time the epidermis becomes thickened and may form hardened scales upon the surface. The cutaneous circulation, particularly in the extremities, is sluggish, and coldness and blueness of the hands and feet are commonly observed. The patient's expression is apathetic and the facies are characterized by a peculiar haggardness.

The abdominal examination frequently reveals abnormal distention. This may be seen in the left hypochondriac or the umbilical region; but more frequently the upper part of the abdomen is hollow and depressed in a transverse furrow, while the hypogastric region is greatly distended. In advanced cases the hollowness of the epigastric region in contrast with the lower portions of the belly is a striking and significant fact. Not rarely peristaltic waves may be seen passing from left to right over the distended stomach, and occasionally reversed peristalsis or antiperistalsis may traverse the swelling from right to left. The veins of the lower portion of the abdomen, particularly those passing upward over the iliac fossæ, are habitually enlarged and prominent.

*Palpation.* In cases in which the abdominal walls are lax it may be possible to feel the lower margin of the greater curvature throughout a considerable portion of its extent through the abdominal walls; and when the organ contains a certain amount of water it may be possible to produce a succussion-splash palpable to the examining-hand. More commonly no definite outline is palpable, but the peristaltic waves before referred to may be felt passing to and fro. Palpation is frequently of service in differential diagnosis in determining the existence of pyloric thickening or new growths.

*Auscultation.* Auscultation over the stomach frequently demonstrates signs indicative of the passage of liquid from the oesophagus into the stomach. The significance of these sounds, however, remains more or less doubtful, and they are of no practical service in the diagnosis of

dilatation. Of some importance are the succession-sounds heard when the stomach contains a certain amount of liquid and air. In themselves these sounds are of no special significance, since they are discovered in stomachs presumably healthy. When, however, they occur at times at which the stomach should normally be entirely free from liquid contents, their significance at once becomes apparent in indicating loss of motor function and abnormal retention of the gastric contents. These succession-sounds vary very greatly in intensity, and certainly in the normal stomach never become distinct enough to be plainly audible at a distance, while in gastric dilatation we have repeatedly found them so distinct that they could be demonstrated to students standing about. Besides the succession-splash another auscultatory phenomenon deserves mention, namely, the loud gurgling or rumbling sounds occasionally heard. Patients are frequently able to develop these when standing upright, and their significance is open to considerable question. For ourselves we have always felt that the existence of these sounds was indicative of gastric or intestinal relaxation, though it must be confessed that they are heard in cases in which dilatation could scarcely be supposed to exist.

The splashing-sounds referred to before may easily be simulated by sounds originating in the transverse colon or in other parts of the intestine and resulting from the presence of gas and liquid within the viscera. In cases of doubt, therefore, the colon should be carefully freed from its contents before the test is applied.

Of late, the attempt has been made to determine the existence of atony or of dilatation of the stomach by the amount of liquid necessary to produce splashing-sounds. This test, however, in common with others which we shall have occasion to allude to, lacks precision and significance, principally because of the varying capacity of the stomach in different individuals, and because of the danger of mistaking dislocation of the organ for dilatation.

We shall refer again to auscultation in connection with percussion in describing the method of auscultatory percussion.

*Percussion.* The determination of the outline of the stomach by percussion is open to a number of fallacies, and deductions cannot properly be drawn on account of the varying anatomical conditions. Neither the relations of the various borders of the stomach to the different bony points of the thorax nor the actual measure of gastric tympany obtained in transverse, vertical, or other directions are reliable on account of the differences in structure and contour of the thorax in different persons,

on the one hand, and on account of the very wide variation in the size of the stomach in presumably healthy individuals, on the other hand. In so far as the value of percussion itself is concerned, it must be recognized that the amount of distention, the quantity of material contained within the stomach, and the condition and position of adjacent viscera must largely influence the results. In particular, the position of the lower border is difficult to determine from the fact that the tympany obtained over the transverse colon may so closely resemble that obtained over the stomach that an accurate separation of the two is impossible. In the second place, not rarely the colon overrides the stomach and thus makes the determination of the lower border of gastric tympany impracticable. - When the left lobe of the liver is enlarged or unnaturally prominent in the epigastrium it is difficult or impossible to determine the exact outlines of the stomach even though it be quite well distended. To a certain extent percussion may be rendered more precise and valuable by cleansing the colon carefully, and by repeating the percussion in different positions; but despite these precautions no reliable deductions can be drawn.

*Other Methods of Determining the Size and Capacity of the Stomach.* Perhaps the oldest method devised for this purpose is that of Leube, of introducing a stiff sound and palpating the end through the abdominal walls. The dangers and unreliability of this method have, however, led its originator himself to abandon it, and the method is no longer practised anywhere.

A variety of methods have been introduced which, for the most part, depend upon the amount of liquid that may be introduced into the organ. These, however, are all subject to objections of a serious character. The tolerance of the patient varies so greatly that one will complain of pain when the stomach is scarcely at all distended, while another will bear the greatest possible amount to be introduced. This objection alone would suffice to make these methods unreliable were there not the greater difficulty—that stomachs vary widely in their capacity in different individuals of the same age, size, etc. We therefore place no reliance at all on these methods excepting so far as it may be assumed with tolerable certainty that a stomach which will accommodate 2.5 or 3 litres is probably larger than normal. The usual standard that has been adopted is 1700 c.cm.; but this is certainly too small to warrant positive deductions. In another group of methods the attempt is made to localize the lower border of the organ, and of these that which has attracted most attention is the method of Dehio. This observer, it will be recalled, deter-

mines the lower border by introducing measured quantities of water into the stomach and determining the lower border by percussion, the patient standing erect. He has determined that the lower border will be found 11.5 cm. below the end of the sternum after the introduction of one-quarter litre of water, and that the border descends between 2 and 3 cm. with each additional quarter litre introduced; but that in the normal individual the lower border never descends below the umbilicus. With this last conclusion we are quite ready to agree, though we cannot regard the method free from objections or its results valuable in the diagnosis of dilatation. Our own studies with other methods lead us to entirely the same conclusions regarding the lower border, viz., that it always lies above the umbilicus. When, however, it is found below the umbilicus the conclusion is by no means warranted that the stomach is dilated. The same thing will be found in dislocated stomachs, and this condition, we are convinced, is one of great frequency. The method itself is open to some objections which impair its reliability; but, on the whole, it is useful for the determination of the lower border of the organ. The great weakness of Dehio's plan, or rather the great error of many of those who have used it, is the interpretation that has been placed upon the results. We still employ the method and find it satisfactory; but in all cases we seek to control the result by auscultatory percussion and by inflation, and in particular to determine the position of the lesser curvature and of the pylorus. If, then, by Dehio's method we find the lower border of the organ below the umbilicus and the pylorus and lesser curvature similarly depressed, we conclude that dislocation or vertical position is the cause of the depression of the lower border rather than dilatation.

Finally, we would add a few words regarding the method of illumination. This, we must confess, has not from the first appealed to us as a practical method, though in hospital practice it seemed to offer the hope of accurate and useful results. Our own experience is very limited and not very encouraging; and if the results of Martius and Meltzing indicate the conclusions as to the normal situation of the stomach, and are to be attributed to the method, and not to their having investigated cases of gastrophtosis, we are disposed to believe that gastrodiaphanoscopy will not prove a reliable guide. Certainly the method of inflation, which can scarcely give erroneous results when it is at all successfully practised, and the experience of post-mortem examination do not warrant the belief that the stomach normally occupies a position so far down in the abdomen as Martius and Meltzing have found. It seems

likely to us that the light radiates through adjacent coils of intestine and thus gives rise to false impressions.

There remain two methods of examination, the value of which we have tested in many cases and of which we feel fully convinced.

*Auscultatory Percussion.* For some time past we have practised this method in view of the unreliability of simple percussion. Auscultatory percussion, though by no means an original or novel method of examination, has not, we believe, received the attention it deserves, nor has its reliability been sufficiently investigated. In our own experience with this method, not only in the examination of the stomach, but also of the heart, the liver, and other solid viscera, we have become convinced that its results are far more accurate than those of ordinary percussion, and that, so far as the stomach is concerned, it may be depended upon to furnish a reliable indication of the position, and, to a certain extent, of the size of the organ under the conditions present at the time of the examination. Of course, it is open to some of the objections which may be urged against ordinary percussion, namely, that the distended colon may cover over the inferior border of the stomach, and that the results must vary according to the degree of distention of the stomach itself. It is not, however, liable to the error that the left lobe of the liver may obscure the gastric tympany, as the note is readily transmitted through this to the stethoscope. In applying the method to the examination of the stomach we use a double stethoscope with long rubber conductors, so that while the patient supports the bell first near the position of the fundus, then below and toward the body or pyloric end, the observer is able without discomfort to perform the percussion, approaching the stomach gradually from all points. Next, the percussion is reversed, the finger or pleximeter being placed over the stomach itself and near the bell of the stethoscope; then gradually carried outward toward the periphery until the limits of the organ are passed.

In this manner it is extremely easy to determine the exact limits as far as the method permits of accuracy, and we have repeatedly found that several persons practising auscultatory percussion at the same time have obtained limits which did not vary above  $\frac{1}{2}$  or 1 cm. Furthermore, in cases in which we have practised this method and in which subsequently inflation with atmospheric air was used, or in which the accuracy of the determination was controlled by post-mortem examination, we have found that the outlines of the stomach, as determined by the auscultatory percussion, have been extremely reliable. In normal individuals the positions of the fundus, of the lesser curvature, of the lower border, and of

the pylorus, have generally corresponded with the outlines given by Luschka; while in cases of dilatation and in cases of gastrophtosis wide variations from the normal position or size have been readily demonstrated.

*Inflation.* Far more useful, however, than any of the methods thus far described is that of inflation. A number of methods have been proposed, the best known of which is that performed by administering sodium bicarbonate followed by tartaric acid. Our experience with this method is comparatively limited, as the objections which have been urged against it, and which have occurred to us, have made us hesitate to employ it, except in occasional instances; and, further, because we have found the method of inflation with atmospheric air entirely satisfactory. The administration of effervescing mixtures seems to us objectionable from the facts that the distention is entirely uncontrollable, and that in cases of ulceration or other disease of the stomach dangerous results might follow. Thus we have known of cases in which considerable irritation was produced, and others have been reported in which actual hemorrhage was caused. The method is unreliable also in that at times the amount of gas generated falls short of that necessary for distention of the stomach. Still further, it may be objected that sudden and intense distention may give rise to serious pressure or reflex disturbances, though no actual cases proving this suspicion are known to us. On the other hand, the method of inflation with atmospheric air has the one objection, that it necessitates the passage of a stomach-tube; but this is certainly an objection of little importance. There are, of course, certain cases in neurotic or oversensitive individuals in which the passage of a tube may be objectionable; but where the necessity of making an accurate diagnosis of a possibly serious gastric disease arises, objection to the passage of a stomach-tube is certainly scarcely worth consideration, and, as accurate diagnosis will require the passage of the tube for other purposes, it is not likely that this objection will interfere with the application of the method. For the purpose of inflation we employ a simple bulb, such as that used in the ordinary Davidson syringe, and begin the inflation by vigorous and rapid compressions, so that the amount of air projected into the stomach at the beginning may be as considerable as possible. In this way it has seemed to us that the pylorus is at once placed in a condition of spasm or contraction, and that thus the escape of the air into the intestine is prevented. The latter accident, however, does sometimes occur in cases of relaxation of the pylorus; but more frequently some of the air tends to escape along the

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œsophageal tube. The stomach is soon filled and becomes plainly visible through the abdominal walls, so that its size, its outline, its position, and, most important of all, the position of the upper curvature, the pylorus, and the inferior border, are readily made out. We have employed this method in numbers of cases of gastric dilatation and other conditions, and have come to regard it as the only satisfactory means of determining the size and position of the stomach.

We proceed now to the second point of importance in the diagnosis of gastric dilatation: to the determination of the motor activity or sufficiency of the walls of the stomach. Here, too, we find a number of methods recommended. Among the older of these is the salol-test, to determine the duration necessary for propulsion of the contents into the duodenum, the assumption being made that the decomposition of the salol speedily follows its entrance into the alkaline intestinal secretions. According to Ewald, this takes place and the resulting salicylic acid appears in the urine within forty to sixty minutes, in health, and not until a much later period in gastrectasis. It is unnecessary to enter upon the discussion of the merits of this test. Numerous observers have found and our own experiences have taught us that Ewald's method possesses no practical usefulness.

Another plan proposed was that of introducing a measured quantity of oil into the stomach and removing the portion remaining after two hours with the stomach-tube. This method has the great disadvantage that complete removal of liquids from the stomach is often impossible, and that the limits of normal motor activity probably vary more widely than such a test would permit us to believe.

The most reliable method of direct determination of motor insufficiency is that of v. Leube. According to this observer, all traces of a meal of meat, soup, and bread disappear from the stomach in the course of seven hours when the motor activity is normal. When atony is present food-remnants may be found at much longer intervals after the meal; and even on the morning of the next day when the test-dinner was given in the evening. This method is easily practised, and, in view of the wide variations which doubtless exist in different individuals, is as accurate as we may expect.

The elaborate methods of measuring and recording motor activity with the aid of instruments, acted upon by columns of water or air compressed in bulbs or other contrivances introduced into the stomach, are cumbersome, impracticable, and therefore useless. It is, therefore, unnecessary to consider their sources of error.

Dehio has claimed that his method of determining the lower border of the stomach by introducing measured quantities of water is useful also for the estimation of motor activity. He has found that in cases of atony the lower border of the stomach descends to the umbilicus with the addition of only moderate quantities of liquid, while the border in dilatation is found below the umbilicus even after the introduction of the first quantity. From such differences in different cases he would determine the less or greater motor power. This assumption, however, seems to us an unwarranted one, and we agree with Riegel in his assertion that greater elasticity does not of necessity imply less motor power; but entirely aside from this point, the method of Dehio is fallacious, in that it does not take into consideration movability of the stomach apart from dilatability. In addition to these methods of determining the motor power directly, there are certain examinations, particularly the chemical investigation of the gastric contents, which furnish evidence of the decay of food in the stomach. The most striking and obvious feature is the decomposition which leads to sour and ill-smelling vomita. To a certain extent this is a measure of the motor insufficiency, as is also the presence or absence of *sarcinæ*, yeast-fungi, and other organisms of fermentation and putrefaction. In cases of extreme delay of the contents of the stomach decomposition of the starchy and saccharine foods may lead to the fermentation of lactic, acetic, butyric, or other fatty acids, while putrefactive changes of proteids lead to ill-smelling gases containing sulphuretted hydrogen in particular. The existence of these substances in vomited matters, or in the stomach-contents removed with the tube, is always indicative of undue retention of the food. The amount and kind of decomposition that prevails depend to a large extent upon the kind of food taken and the character of the gastric secretion, especially upon the presence or absence of free hydrochloric acid. Boas has recently maintained that the presence of lactic acid in the stomach-contents after a test-meal containing no lactic acid is specially significant of carcinoma. This point is in a measure established, though it has not the pathognomonic importance Boas sought to give it. Lactic acid is occasionally found in non-malignant cases, as in one of our present series. On the other hand, repeated examination may fail to show it in cases of carcinoma, as we have found. We need not enter more fully upon this controversy now. Suffice it to say that lactic acid when present is an indication of stagnation.

The amount of urine is another indirect evidence of motor insufficiency. Von Mering's investigations and the subsequent clinical observations

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of many others have shown that the mucous membrane of the stomach plays little part in absorption, either of liquid or of other matters. In consequence, obstruction of the pylorus and vomiting lead to rapid desiccation of the tissues and to decrease in the quantity of the urine. This decrease, however, is largely dependent upon associated conditions, and may fluctuate considerably, so that the exact quantity is of little value in diagnosis or in determining the degree or progress of the disease.

We have thus sketched the principal methods of investigation and points in the symptomatology which are of value in the determination of gastric dilatation. Of necessity allusion has been made to certain methods which we do not ourselves employ, and of whose value and reliability there may be much question. The methods upon which we rely are those of auscultatory percussion and inflation, and upon Dehio's method for determining the lower border of the organ. The mere determination of one or another of the borders of the stomach is of little value; but taken in connection with the other portions as determined by the same or supplementary methods of investigation, and with the discovery of deficient motor activity, the diagnosis can generally be made with ease. Mistaken diagnoses are more often the result of insufficient examination than of unreliability of methods at hand.

DIFFERENTIAL DIAGNOSIS. The points upon which this will rest have been more or less thoroughly considered; but it seems advisable to point out certain contrasted conditions with the indications pointing to one or the other, and to consider somewhat the methods by which an opinion may be formed as to the original cause.

*Megalogastria and Gastrectasia.* Ewald, Riegel, and others have described cases of enlargement of the stomach without symptoms of functional disturbance. Such cases are doubtless instances of physiological or natural largeness of the stomach, and may properly be designated as megastria or megalogastria. What we have before said regarding the variation in the size of the stomach in different persons need not be repeated, but it is clear that no definite limits can be assigned to what may be considered a normal stomach. How large a stomach may be without danger of stagnation of food on account of the mere capaciousness is difficult to say, and cases of enlargement sufficient to be certainly recognized by clinical methods, and in which no symptoms of dilatation are found, are comparatively rare. The diagnosis is simple enough, and depends altogether upon the fact that no sign of stagnation of food or of serious disturbance of digestion can be discovered. The only difficulty offered is to distinguish cases of obstructive enlargement with com-

pensatory hypertrophy of the walls of the stomach. In the latter, however, there is always a history of gastric disease running backward for varying periods; and usually, if not always, the compensation is only partial, some deficiency of motor activity being present. The general appearance of the patient also gives important indications, and in cases of non-malignant pyloric stenosis there is usually excessive acidity of the gastric secretion, and subjective symptoms more or less severe.

*Gastrophtosis and Gastrectasia.* Displacement of the stomach—the vertical position of Kussmaul or gastrophtosis of Glenard—has long been recognized; but its frequency has been underestimated, and without doubt it has often been mistaken for gastrectasia. A consideration of the anatomy and relations of the stomach is convincing of the fact that displacement must affect the pyloric end almost entirely, while the cardiac end and fundus are more or less normally situated. The result of displacement, therefore, is a vertical position such as occurs in the newborn. In normal individuals, after early infancy, the position of Luschka is assumed and retained; but very often, as a result of the pressure of clothing about the waist or of other causes, displacement occurs and causes the pyloric end to fall to lower levels than normal. The frequency of such pathological position is probably greater than has been generally believed, and in our experience with inflation of the stomach we have found it surprisingly frequent.

In gastrectasia the pylorus usually also descends somewhat, though rarely so much as in gastrophtosis. When studied in relation with the lower border the position of the pylorus is found relatively little displaced. Dilatation habitually affects the greater curvature near the pyloric end more than other parts,<sup>1</sup> and in consequence the distance between the pylorus and the lower border becomes excessive. This is well seen in some of our diagrams (Figs. 2, 3, and 4) as well as in illustrations given by various authors.

These considerations show the value and necessity of determining the position of the pylorus and lesser curvature as well as that of the lower border, and the unreliability of basing deductions upon Dehio's method alone. If the pylorus is not much displaced and the lower border is below the umbilicus, dilatation probably exists; but if the pylorus is near the umbilicus, the low position of the lower border loses its signifi-

<sup>1</sup> Certain investigators have found that the portions of the stomach near the pylorus are especially active in expelling the contents. It is clear, therefore, that those parts would suffer most distention in cases of obstructive dilatation. In any event, however, the most dependent part of the organ would be prone to dilate.

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cance. In certain cases of gastropostosis a moderate amount of associated dilatation may exist. In such cases the diagnosis, as far as the mere estimation of size is concerned, depends upon our judgment as to whether the descent of the lower border is out of proportion to that of the pylorus and lesser curvature or not. The absolute diagnosis, however, in such cases depends upon the determination of the motor activity of the walls.

*Obstructive and Atonic Gastrectasia.* The differential diagnosis between these conditions may be extremely difficult in some cases, particularly when the early history is wanting. Where a distinct neoplasm is discoverable the diagnosis becomes a simple one; but in the absence of this it must depend upon a consideration of the course of the disease, and to a certain extent upon the degree. Very rarely does atonic dilatation reach the enormous grades sometimes witnessed in obstructive gastrectasia. In addition, it will be found that the course of the case is less regular and progressive. Not rarely there will be a history of early remissions and accessions in the disturbances, and when the patient is continuously under observation marked variations may be noted from time to time. Physical examination is less apt to discover peristaltic waves, and the chemical examination shows no such marked excess of HCl as is seen in many cases of non-malignant stenosis. It must be admitted, however, that some cases of dilatation beginning with hyperacidity and hypersecretion are atonic rather than obstructive. Obstructive dilatation differs in its course mainly in that it is progressive and persistent. The earlier stages, during which compensation is maintained, may be marked by few symptoms; but after compensation fails, and often this occurs quite as abruptly as failure of compensation in cardiac disease, the disease is lasting and quite regular in its downward course. The dilatation in this stage often reaches proportions never attained in atonic cases.

*Malignant and Non-malignant Obstructive Gastrectasia.* The general appearance of the patient gives us less information than we might expect. Not rarely, as has been noted, the patient assumes a cadaverous, cachectic appearance in entirely non-malignant dilatation; while, on the other hand, instances may be found of cancerous obstruction in which the general appearance of the patient is quite good. The investigation by physical examination, and particularly the chemical examination, may furnish important diagnostic factors. The most significant fact is the discovery of excess of HCl in certain non-malignant cases. The mere presence of hydrochloric acid, even in cases of excessive obstruction with dilatation, does not exclude carcinoma, as we have several times found;

but excessive hydrochloric acid does not seem ever to occur in such cases.

The presence or absence of lactic acid has been urged by Boas as a fact of diagnostic value. This, however, requires further confirmation. Boas himself admits the occasional presence of small quantities in non-malignant dilatation, and one of our present series of cases showed the same. On the other hand, lactic acid may be absent in cases of cancer, as we have also found. On the whole, however, it seems fairly well established that the occurrence of lactic acid (when sought after according to Boas's method) is a point of considerable value as indicating carcinoma. Further, it has been held by Boas that albuminous decomposition with production of sulphuretted hydrogen occurs in benign rather than in malignant cases; but we have found it present in both forms.

The discovery of a palpable tumor in the pyloric region is the most suggestive fact of all, and usually serves to establish a positive diagnosis. At the same time it must be remembered that hypertrophic thickening of the pylorus may simulate carcinomatous tumors, and that enlarged lymphatic glands and even the head of the pancreas may be felt and mistaken for carcinoma. Recently examination of the blood has been suggested as a means of making a differential diagnosis, the studies of R. Müller and Schneyer showing that digestive leukocytosis is wanting in carcinomatous stenosis but normal in other cases. Finally, the rapid progress of the case, occurring in a person beyond the age of forty, and without a history of prolonged gastric troubles, adds to the probability of the cancerous nature of the obstruction.

*CASE I. Obstructive dilatation; non-malignant stenosis of the pylorus.*—C. M., aged thirty-five years, a laborer, was admitted to the hospital December 7, 1895. His father had died at the age of forty-five years, the cause not known. His mother and four sisters are living and in good health. One sister died of pneumonia. Nothing in his family history bears on his present case.

He himself was a healthy lad until about his twentieth year, when he had a vague attack of malarial fever and was confined to bed for three weeks. In 1883 he was injured in a coal-mine, and in 1884 was again injured. In 1890, while working in an iron-mill, he was overheated and afterward chilled. This led to an illness which was called hepatitis and which confined him to bed for fifteen weeks. There were chilliness, vomiting, and a great deal of pain, the latter referred to a point on the right side between the anterior superior spine of the ilium and the umbilicus. The patient has always been a temperate man with regard to the use of alcoholics and chewed tobacco

only moderately. He was careful in his manner of eating, generally taking his food regularly and chewing it well.

The illness which brought him to the hospital was gradual in onset and had been increasing during the past two years. He first noticed eructations of gas and then began to suffer with a heavy feeling in the stomach, relieved by vomiting. The latter did not begin until some time after the first symptoms, but became constant after their onset.

*Physical examination.* When the patient presented himself he was considerably emaciated, the malar bones standing out prominently. His voice was rather hoarse, his skin dry and scaly, and in general there was a desiccated appearance. On examination, it was found that the upper part of the abdomen (epigastrium) was rather hollow, while the lower part (below the umbilicus) was greatly enlarged. The superficial veins, especially those on the lower and lateral portions of the abdomen, were much enlarged. The size of the stomach was determined by auscultatory percussion and found to be unusually large. Splashing-sounds were evident when the fingers were pressed against the abdominal wall as well as on shaking the patient. The contents were removed with the stomach-tube and were found to consist of 2500 c.cm. of horribly offensive decomposed material. Chemical analysis of this showed a total acidity of 67, with a considerable proportion of free HCl (40 by Braun's method for free and combined HCl), and lactic acid in considerable quantity (Uffelmann's test).

The patient's blood was examined, showing 3,863,000 red corpuscles and 9300 white corpuscles. The urine showed as follows: volume for twenty-four hours, 1718 c.cm.; turbid and yellowish; reaction slightly alkaline; specific gravity 1020; no albumin; no sugar;  $P_2O_5$ , 3.126 g. (0.182 per cent.).

The patient was ordered lavage and a graduated albuminous diet, with a restriction of liquids, electrical stimulation, and colonic douches. Under this treatment his general condition improved somewhat, though the condition of the stomach remained about the same.

It was constantly found that the food of the previous day could be removed from the stomach in the morning, and sometimes portions of food from several days previous were thus obtained. There was constantly excessive acidity, and free hydrochloric acid was invariably found present, the quantity ranging from 30 to 56. Lactic acid was occasionally present to Uffelmann's test, but was never detected by Boas's method, though repeatedly sought for.

The size of the organ was evidently greatly in excess of the normal, and in practising lavage it was found that from  $2\frac{1}{2}$  to 3 litres caused no particular discomfort. Auscultatory percussion found that the organ extended from its usual position beneath the left lung and heart downward as far as the umbilicus and even further, and that the pylorus, though somewhat depressed, was separated from the lower border by a considerable space. Inflation with air gave a similar result, and the organ was readily demonstrable to a class of students in an amphitheatre.

FIG. 2.

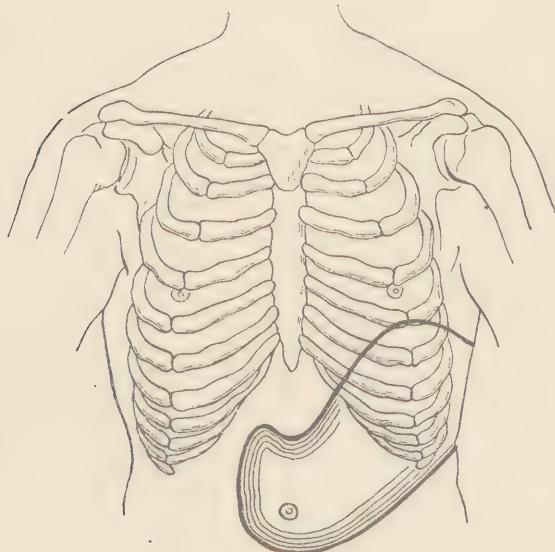
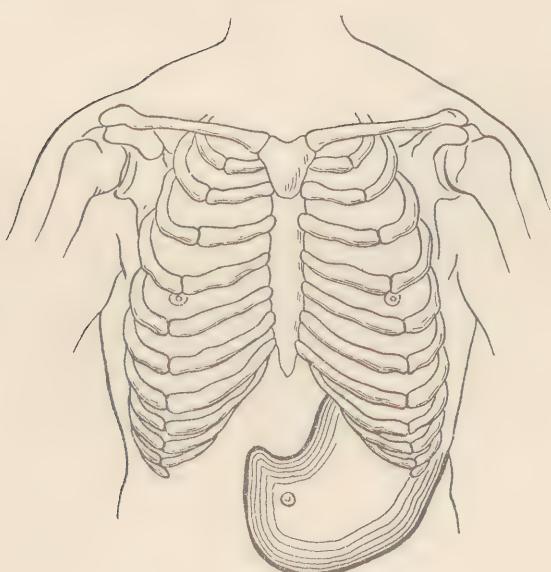


FIG. 3.



The patient's general condition improved somewhat, but he continued to have burning pain, heaviness, disturbances of sleep, and attacks of vomiting. It was finally decided to operate. Dr. J. William White was called in and performed the operation of divulsion, finding the obstruction at the pylorus due to a circular ring of dense sclerotic tissue, which at first sight presented the appearances and feeling of a carcinoma.

The subsequent history of the case was eminently satisfactory, the recovery from the operation being prompt and the restoration of the stomach to its normal functions almost complete.

Lavage has been practised on two mornings and no food-remnants of the previous day obtained. A Boas's test-meal was found to have passed into the intestine after two hours.

CASE II. *Obstructive dilatation; carcinoma of the pylorus.*—C. L. P. was seen with Dr. Lee H. Smith, of Buffalo. The patient, a banker, aged fifty-four years, was treated twice in 1887, being operated upon for stricture of the urethra the latter time. A cure of this disease was effected, and there does not appear to have been any recurrence of the trouble. His general health since then continued to be very good until September, 1895, when he noted obstinate constipation—not relieved by usual exercise and diet. He never had any severe illness which confined him to his bed, but has always been bilious at times. Within two months of his death he began to lose weight very rapidly, and in five months the loss amounted to thirty pounds. Within the last three or four weeks of his life he vomited a few times. His digestion became very poor. Frequently his food gave distress, and sour, windy risings from the stomach were distressing. Bowels inclined to be constipated; no jaundice. He suffered with piles, especially when the bowels were constipated. The lungs and heart were examined with negative results, excepting slight cardiac debility. His general circulation was weak, due to anaemia. When the patient came under our notice the above symptoms and history were obtained from Dr. Smith, and in addition we made careful examination of his abdomen and stomach. There was extreme emaciation, and the skin presented an ashy hue. The abdomen was depressed above (hypochondriac and epigastric regions) and distended in its lower portions. A small tumor could be felt in the right side above the umbilicus, and on auscultatory percussion the size of the organ was found to be enormous. Splashing-sounds were very evident. Inflation was practised, and the stomach was found to occupy the position represented in the accompanying diagram.

Repeated examinations of the gastric contents had been made and the total acidity was habitually decreased; free hydrochloric acid was never discovered. Lactic and butyric acids were occasionally present, but it is not stated that special precautions were taken to exclude lactates from the test-meals. Pepton was often found. Sarcinæ were seen microscopically; but no cancer-cells or acini.

The urine was high-colored and heavy (1028); contained excess of indoxylo, sulphuric acid, and a trace of albumin with fine granular casts.

The diagnosis of dilatation due to carcinoma of the pylorus was easily arrived at, and was subsequently confirmed by an operation performed by Drs. J. William White and W. W. Keen.

CASE III. *Obstructive (?) dilatation; movable kidney.*—Miss M. P., aged twenty-nine years, a typewriter by occupation, was admitted to the hospital December 10, 1893. Her father was killed in an accident; her mother was still living and had an aneurism of the aorta. She had had the usual infectious diseases of childhood, and especially diphtheria, which she had three times. In November of 1891 she had typhoid fever. The following notes were recorded:

Her present illness seemed to begin in June of 1892, when she first began to suffer with pain in the left hypochondriac region and with flatulence. The ingestion of food was followed by burning pain and by heaviness, but there was no vomiting. Previous to this time she had suffered with no disturbances of the appetite or digestion, and her bowels had been entirely regular. In July of 1892 she was thrown from a carriage and severely bruised. From this time the symptoms continued and gradually grew worse until March, 1893, when vomiting commenced. The matters vomited were dark in color and always extremely sour. At first this occurred at long intervals, but finally during the summer it was sometimes repeated several times a day. The patient became very much wasted and constipation grew progressively more intense. There were no menstrual periods after August, 1893. She complained of continuous pain and sometimes of sharp paroxysmal attacks.

*Physical examination.* The patient was emaciated and the abdomen rather flat. During the examination, however, a distention appeared below the border of the left ribs, constituting a veritable phantom-tumor. The percussion-note over this was low-pitched and tympanitic. Peristaltic waves were plainly visible, and on shaking the patient a succussion-splash was quite audible. The distention appeared and disappeared rather rapidly during the time she was under examination. The lower part of the abdomen was somewhat fuller than the upper. In the right hypochondriac region and toward the umbilical region there was found a hard, kidney-shaped tumor which was painful on pressure and easily movable. The condition of the other abdominal organs and the thoracic viscera seemed normal.

The patient was ordered repeated rectal enemas, but diarrhoea set in and the treatment was discontinued. For some time the condition remained the same, and from time to time she had attacks of vomiting, the matters discharged frequently being remnants from the previous day.

Examination of the gastric contents, after an Ewald test-meal, showed diminished acidity (10 to 20 NaHO); no hydrochloric acid; lactic acid present (Uffelmann's test).

Careful regulation of the diet, for the most part peptonized milk; rest in bed; faradization over the stomach and back; cod-liver oil, given by the

mouth or by inunction; and occasional intestinal lavage, constituted the treatment. Her condition gradually improved, and in the course of four months she had gained thirty pounds. The kidney-shaped tumor, which had been plainly palpable during the first two months, had gradually receded until it was no longer palpable, and the stomach on physical examination (by auscultatory percussion) was found to occupy its usual position and had seemingly the normal size.

The patient returned somewhat later, reporting that she had resumed her usual occupation, and she was found to be in excellent health, having suffered no further discomfort from indigestion, vomiting, or pain.

In this case inflation of the stomach was not practised, the diagnosis of dilatation therefore resting upon the determination of marked failure in the motor power by the discovery of food-remnants in the fasting stomach, upon the apparent enlargement obtained by auscultatory percussion, together with the active peristaltic waves visible through the abdominal walls, and finally the subsequent disappearance of all of these conditions.

*CASE IV. Atonic and obstructive dilatation, due to a cicatrix in the anterior wall and adhesions surrounding the pylorus.*—P. D., aged fifty years, a shoemaker by occupation, was admitted to the hospital January 3, 1896. The following notes were recorded:

The family history of the patient does not bear upon his illness. The patient was married and has five healthy children.

He was a healthy man excepting for an attack of malaria which he had ten years ago. He has used alcohol very little and tobacco not at all. He has always been careless in his habits of eating, bolting his food with insufficient mastication. His appetite has always been good and he has habitually eaten large quantities of food.

About five years ago he had some trouble with his stomach, but no severe discomfort. Eructation of gases was the most pronounced symptom, and occasionally at long intervals he would vomit.

About a year and a half ago there was a severe spell, coming with a chill and accompanied by fever and vomiting, which confined him to bed for three months. The stomach was absolutely unretentive. He finally recovered and returned to his work. Six months or a year later, however, he was seized with the same sort of an attack and was confined to bed for four months. During the attacks he lost much flesh, but on recovering again gained weight.

The summer after the last attack he felt as well as ever, but continued his habits of rapid eating, and about September, 1895, the present condition began.

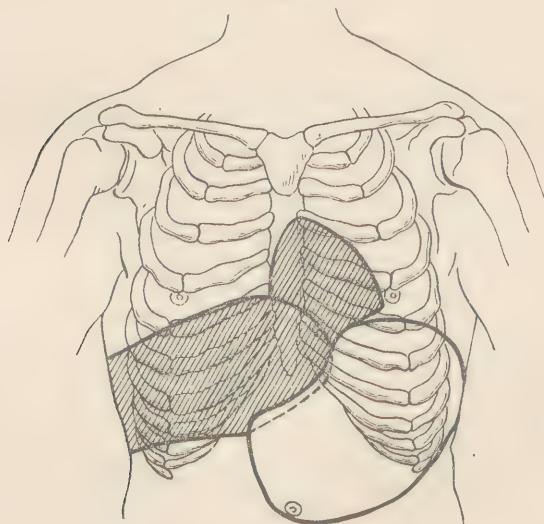
The first symptoms were marked eructations of gases, heartburn, and con-

tinuous pain in the epigastrium. The latter was relieved by eating; but this food was not digested, and invariably was vomited after several hours in an undigested condition. Sometimes he has vomited enormous quantities of sour, watery, and yeasty matters, but has never noticed blood. His bowels are very costive and the quantity of urine is diminished. Now and then he complains of an aching pain running down the limbs.

*Physical examination.* The patient has an elongated frame. The lower part of the chest and the end of the sternum are depressed, as are also the epigastric and hypochondriac regions; whereas the hypogastric and lower umbilical portions are distended, and the superficial veins along the sides and front of the abdomen are enlarged.

The stomach was outlined by auscultatory percussion and was found to measure 17.5 cm. in a vertical direction and 22 cm. in the transverse direction. The lower border is on a line with the umbilicus; the upper border lies beneath the fifth rib. (The outlines are illustrated in Fig. 4.)

FIG. 4.



The cardiac outline is not increased and the liver is apparently normal in size. Careful palpation reveals no evidence of a tumor, but in the epigastric region toward the left costal border there is felt a distinct resistance.

The contents of the stomach were removed with the stomach-tube, and were found to consist of decomposed, sour, ill-smelling liquid. Chemical examination of this showed excessive acidity, varying from 30 to 120 on different occasions. There was always free hydrochloric acid, the amount of the latter varying from 10 to 50. Lactic acid was frequently present to

Uffelmann's test; and on two occasions, when Boas's test-meal was given and all other precautions were taken, the reaction was still positive.

The stomach was emptied at varying periods after meals, and always contained food-remnants; and not rarely vomiting would bring up food taken on the previous day. The amount of liquid discharged by vomiting was often very great (2500 to 3500 c.cm.).

The urine was usually a little turbid, alkaline in reaction, and varying in its specific gravity from 1015 to 1020. No albumin or sugar, but excessive deposits of alkaline salts (phosphates and carbonates). Indican was found in excess.

The patient was placed upon a carefully regulated diet of albuminous character. Lavage of the stomach and cold douches of the colon were given at regular intervals, and at times nutritive enemata were ordered. No improvement occurred, and operation was decided upon. This was performed by Dr. J. William White. On incision, the stomach was found enormously enlarged, and a dense scar was found in the anterior wall, at the point where the feeling of induration had been detected. The serous surface adjacent to this was thickened. The pylorus itself was healthy, but was constricted by fibrous adhesion springing from the head of the pancreas, the posterior wall of the abdomen, and other adjacent parts.

*CASE V. Atonic dilatation; great improvement after six months' treatment.*—P. J. J., aged twenty-five years, was admitted to the hospital October 20, 1893. There was nothing significant in the family history.

The patient began to work in the coal-mines at an early age and continued to do so until two years before he came under observation. Since that time he had been following various pursuits, but for the year previous was almost incapacitated. He had used alcohol habitually and was always an excessive eater; and, as he himself confessed, he "eat enough for two men."

During the last six years he had had occasional attacks of pain in the stomach. They occurred especially at a considerable interval after eating, and were frequently relieved by vomiting of sour liquids. Eructations of gases were frequent. The attacks increased in severity and frequency until they occurred almost after each meal and quite disabled him from work. His appetite continued excessive, excepting at times when the attacks were not relieved by vomiting. At such times the fermentation seemed to continue and the eructations were always more severe and lasting. The bowels are obstinately constipated, and he had pain in the back. The tongue was generally clean.

*Physical examination.* The patient has a long, narrow chest, and the xiphoid cartilage and the lower part of the ribs are depressed, as is also the epigastric region. The abdomen below the umbilicus is much distended. The superficial veins over the latter part are greatly enlarged. Auscultatory percussion discovers a decided increase in the size of the stomach, the pylorus being somewhat depressed, but the lower border extending fully to

the umbilicus, which is placed at an abnormal distance from the xiphoid on account of the unusual shape of the patient. Careful palpation of the abdomen reveals no induration or tumor and the intestines appear to be normal. The heart and lungs are healthy.

The stomach-tube was introduced and removed considerable undigested food which had remained in the stomach a number of hours; and in washing out the organ it was found to hold two and one-half litres without difficulty. The stomach-contents contained slight excess of free hydrochloric acid, and showed lactic acid to Uffelmann's test.

The patient was placed upon a dry albuminous diet and was ordered lavage of the stomach and regular colonic douches. His condition steadily but slowly improved, and after six months he had gained materially in weight and general appearance. The physical examination of the stomach showed that the pylorus had resumed a more natural position, and the lower border had receded considerably from its former position on the level of the umbilicus. Vomiting had almost ceased, and lavage discovered no remnants of food after six hours.

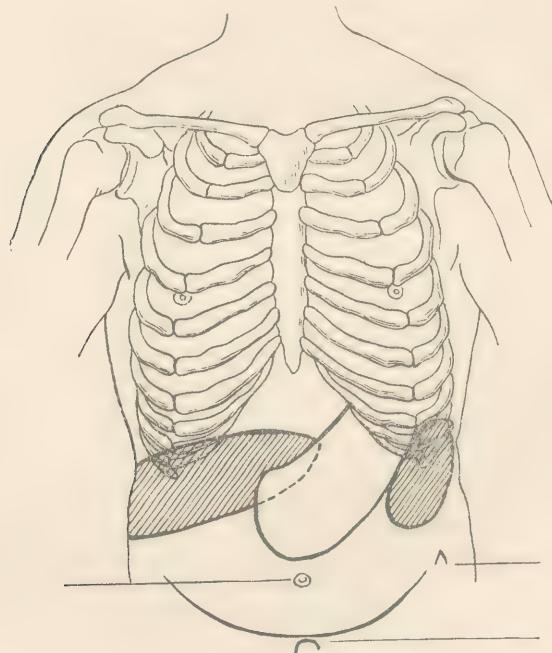
The patient was finally discharged from the hospital, having gained twenty-three pounds in weight and having a comparatively healthy appearance.

CASE VI. *Enteroptosis; displacement of stomach, liver, and spleen; stomach outlined by auscultatory percussion.*—Mrs. B., aged forty-five years; housewife; admitted November 25, 1894. The history obtained was as follows: her father died at the age of eighty-eight years of heart disease; her mother at seventy-seven years of pneumonia. She had two brothers and one sister living and in good health. One brother had died of pneumonia, one of typhoid fever, and one sister in infancy. She herself had been a healthy child and woman; she had had the ordinary diseases of childhood, but not severely. At nineteen she was married, and she had borne nine children. There was one miscarriage at the fifth month. All of her children were large and the labors were difficult. One child weighed sixteen pounds and was delivered with the forceps. The menopause occurred two years ago, since which time she has been growing stout; about the same time she noticed a tumor in the right side of the abdomen. This was moderately painful, and changed its position with different positions of the body. A little later she suffered with pains in the left side, and then noticed a tumor there. When stooping she frequently had sharp pain in the right side, but she has never had any spontaneous paroxysms. She has been moderately jaundiced several times. At times there are shooting-pains around the left side, sometimes extending as far as the left arm, and occasionally she has suffered with attacks of palpitation. She has had attacks of abdominal colic severe enough to produce semi-collapse; and not rarely, after eating, has a feeling of over-distention. The bowels are occasionally loose. She kept on with her housework despite her suffering until four weeks ago, when severe pains in her left side and in the left shoulder compelled her to give up. Shortness of breath, which has

always been present to some extent, still persists, and she has a troublesome morning-cough.

*Physical examination.* The patient is a very large woman, the subcutaneous fat being enormously increased but rather flabby. The abdomen is large and pendulous, so that the umbilicus is greatly depressed and the abdominal fold hangs down over the pubes. There is no fluctuation on careful bimanual palpation. The liver is plainly felt on the right side, the lower edge being 15 cm. below the border of the thorax, and the organ is easily movable up and down and laterally. On the left side the spleen is similarly displaced, the lower margin being 9 cm. below the ribs in the anterior axillary line.

FIG. 5.



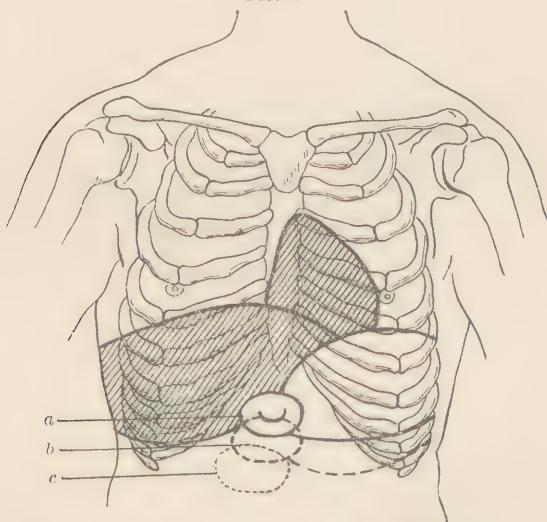
Percussion discovers hepatic dulness 2.5 cm. below the edge of the ribs and extending downward 15 cm., and inward as far as the nipple-line. The position and the outline of the stomach were determined by auscultatory percussion. The area of tympany is on a level with the lower margin of the ribs. The lower margin is almost on the line of the anterior superior spines of the ilium. The umbilicus is displaced downward even below this point on account of the pendulous character of the abdomen. Posteriorly no difference could be detected by palpation or percussion of the two renal regions,

though there were perhaps less resistance and dulness than normal on both sides.

Examination of the urine showed specific gravity 1030; pale amber color; no albumin; no casts; 1.8 per cent. of sugar. During her stay in the hospital the quantity of urine varied from forty-eight to fifty-eight ounces. Her temperature was about normal. Her pulse and respiration varied slightly from the normal. Examination of the blood showed 4,600,000 red corpuscles, 20,000 white corpuscles, and 60 per cent. haemoglobin.

*CASE VII. Cancer of pylorus and liver; position of the growth and absence of dilatation determined by auscultatory percussion.*—D. C., aged forty-eight years, miner, was admitted to the hospital February 8, 1896. The patient's health had been good, though he had suffered with a number of lesser ailments.

FIG. 6.



a. Ordinary position. b. Position on full diaphragmatic inspiration. c. Position when lying on right side. The last position is somewhat exaggerated in the diagram.

He had used alcohol freely, but was not a daily drinker. He chewed tobacco excessively. He was a rapid eater and habitually bolted his food. There was no venereal history.

When he entered the hospital he asserted that he had been entirely well until three weeks previously, when he was suddenly attacked with a severe pain in the abdomen. This was unaccompanied by vomiting or other symptoms and lasted about two hours. The next night another attack occurred, and subsequently they grew more frequent, coming on several times a day. The pain was generally sharp and cramp-like in character.

On physical examination there was found a large tumor occupying the mid-epigastric region and seemingly connected with the lower border of the liver. This was somewhat movable with the respirations and could also be moved from side to side.

Auscultatory percussion of the stomach showed that the pyloric end lay posterior to the mass, and the size of the organ seemed rather restricted than enlarged. With change in position of the patient the position of the tumor and of the stomach-tympany was also somewhat displaced.

Examination of the stomach-contents revealed no remnants of food in the morning or at long intervals after eating. The acidity was reduced, varying from 26 to 42. Free hydrochloric acid was repeatedly discovered, the quantity varying from 15 to 20.

The urine was clear, with a specific gravity of from 1017 to 1025, acid in reaction, and containing some albumin—at times considerable, at other times little. An excessive amount of globulin over serum-albumin was striking. There was no sugar. Hyaline and granular casts and abundant leucocytes were found in the sediment.

The growth of the mass seemed progressive, and finally it was determined to make an exploratory incision. This discovered that the tumor occupied the position between the border of the liver and the stomach, being attached to both. The stomach itself was not enlarged and occupied the position determined by auscultatory percussion.

*CASE VIII. Tumor of the liver; chronic gastritis; pyloric involvement excluded by auscultatory percussion and inflation; subvertical position of stomach.*—N. C. C., aged sixty-five years, a hotel-keeper, was admitted to the hospital July 18, 1895. He had always been a healthy man, but never worked hard. He used tobacco excessively until two years before, but drank only moderately. He ate very irregularly, and constantly bolted his food without mastication.

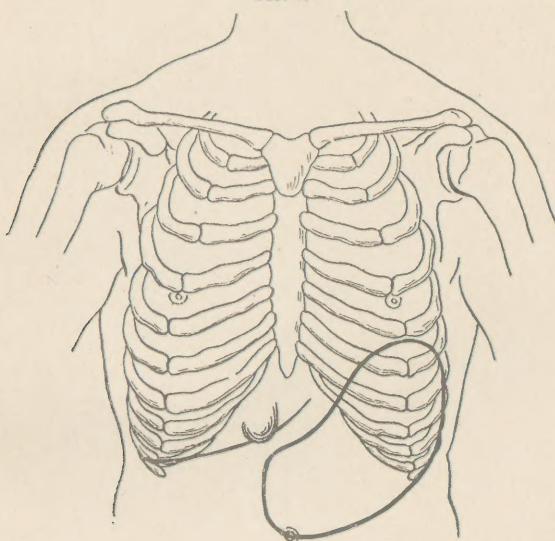
In April of 1894 he began to lose weight and suffered with a dry cough. The loss of weight went on steadily until it amounted to fifty pounds. He became weak and sallow in color; his appetite varied, sometimes becoming ravenous. His bowels acted irregularly, but he was rarely constipated. Occasionally he vomited, but lately not at all. There was practically no pain.

*Physical examination.* The patient is emaciated, sallow, and almost cachectic. The abdomen is rather hollowed, and in the position of the lower border of the liver is seen a distinct, nodular tumor which moves with the respirations. Auscultatory percussion determined that the pylorus lies near the tumor in question or behind it. The liver begins at the fifth interspace and extends 3 cm. below the edge of the ribs. The hepatic dulness is continuous with that of the tumor noted.

The stomach-contents were removed after a test-meal, and hydrochloric acid was found present. Subsequently this test was repeated on numerous occasions, and generally there was found a slight amount of hydrochloric

acid. Sometimes it was absent. Boas's test-meal was given on three occasions, but lactic acid was always absent. There never was any evidence of retention of food beyond the normal length of time, and the stomach was always empty in the morning before breakfast.

FIG. 7.



Examination of his blood showed 4,125,000 red corpuscles, 12,500 leucocytes, and 45 per cent. haemoglobin. The red corpuscles were irregular in shape, but there was no marked abnormality.

The urine was normal in color, acid in reaction, and had a specific gravity of 1018. There was no albumin, no sugar, and no casts.

The stomach was distended with air on several occasions, and it was found to occupy the position seen in the diagram. The lower border was as low as the umbilicus, but the pylorus was also depressed, so that the descent of the lower border was more likely the result of dislocation than of dilatation. When the stomach was inflated it was easy to determine that the mass on the right side was not connected with the pyloric end, as the latter was separated by a distinct and easily determined interval from the tumor in question.

The patient was placed upon a tonic treatment, and was ordered careful diet and remedies directed to the general disturbances of his stomach, supposed to be the result of chronic gastritis.

There was some improvement for a time, but subsequently the condition relapsed. Finally operation was decided upon, and was performed by Dr. J. William White. The mass was found to be a nodular growth in the anterior

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surface of the liver and projecting also to a certain extent upon the posterior surface. The stomach was uninvolved. No portions of the growth were removed, but the wound was simply reunited. The patient subsequently improved almost without interruption, and when he finally left the hospital, three months later, had gained over twenty-five pounds in weight, and suffered no gastric or other disturbances.



